WE CLAIM:

1. An apparatus for mixing fluids within a vessel having a contiguous sidewall centered about and defining a longitudinal axis, the mixing apparatus comprising:

a mixing head having a blade body for immersion in the fluids, the blade body having a first end, an opposed second end disposed in spaced relation thereto along a blade body axis, and a passageway extending therealong between the first and second ends; the passageway tapering from the first end to the second end; the blade body further having an inner surface and an outer surface, the outer surface of the blade body defining an inside blade diameter ID at the second end, and an outside blade diameter OD at the first end;

means for mounting the mixing head within the vessel; and

means for imparting reciprocating longitudinal movement to the mixing head, the reciprocating longitudinal movement being defined by a stroke length S, with a duration T for each cycle,

the mixing apparatus being operable within a set of operational parameters defined by the equation:

$80 \leq 0{:}36 \times OD^2/ID^2 \times S/T \leq 550$,

where OD, ID and S are each expressed in inches, and T is expressed in minutes; and

wherein by virtue of the reciprocating longitudinal movement imparted to the mixing head, a portion of the fluids is urged to flow through the passageway defined in the blade body to thereby encourage efficient mixing of the fluids in the vessel.

2. A mixing apparatus according to claim 1, wherein the stroke length S is between 2 inches and 24 inches.

3. A mixing apparatus according to claim 2, wherein the stroke length S is between 4 inches and 16 inches.

4. A mixing apparatus according to claim 3, wherein the stroke length S is between 8 inches and 12 inches.

5. A mixing apparatus according to claim 1, wherein the OD:ID is greater than 1.0 and less than or equal to 1.7.

6. A mixing apparatus according to claim 5, wherein the OD:ID is between 1.5 and 1.7.

7. A mixing apparatus according to claim 1, wherein the stroke length S is between 8 and 12 inches; and the OD:ID is between 1.5 and 1.7.

8. An apparatus for mixing fluids within a vessel having a contiguous sidewall centered about and defining a longitudinal axis, the mixing apparatus comprising:

a housing positionable above said vessel;

a mixing head having a blade body for immersion in the fluids, the blade body having a first end, an opposed second end disposed in spaced relation thereto along a blade body axis, and a passageway extending therealong between the first and second ends; the passageway tapering from the first end to the second end;

a shaft for supporting the mixing head extending into the vessel;

a reciprocating drive assembly positioned substantially within the housing, the reciprocating drive assembly being operatively connected to the shaft to impart reciprocating longitudinal movement to the mixing head; and

a linear bearing assembly mounted to the housing in surrounding relation to the shaft, the linear bearing assembly including upper and lower bearing subassemblies for engagement with the shaft at respective upper and lower, longitudinally spaced, locations.

9. A mixing apparatus according to claim 8, wherein the upper bearing subassembly is adapted and configured for sliding engagement with the shaft.

10. A mixing apparatus according to claim 9, wherein the upper bearing subassembly includes a pair of mating bushing blocks surrounding the shaft for sliding engagement therewith, each bushing block having a groove formed therein for slidingly receiving the shaft, the grooves of the bushing blocks being mounted in opposed relation one to the other with the shaft disposed therebetween when the bushing block are mated one with the other.

11. A mixing apparatus according to claim 10, wherein the groove formed in each bushing block is lined with a pad fabricated from a self-lubricating material.

12. A mixing apparatus according to claim 11, wherein the pad has longitudinal ribs formed therein.

13. A mixing apparatus according to claim 10, wherein the groove formed in each bushing block is generally semi-circular.

14. A mixing apparatus according to claim 10, wherein:

the housing includes a base, the base supporting one of the bearing blocks of the upper bearing subassembly; and

the shaft is mounted to extend downwardly through the base.

15. A mixing apparatus according to claim 14, wherein the base has a slot formed therein along an edge thereof for accommodating the shaft, the slot being configured to permit the shaft to be laterally received into, and laterally removed from, the slot; the slot being substantially aligned with the groove of the bearing block supported on the base.

16. A mixing apparatus according to claim 8, wherein the lower bearing subassembly is adapted and configured for rolling engagement with the shaft.

17. A mixing apparatus according to claim 16, wherein:

the housing includes a base; and

the lower bearing assembly has at least two roller assemblies carried below the base at the lower location.

18. A mixing apparatus according to claim 17, wherein the lower bearing assembly includes at least one mounting member for operatively connecting the roller assemblies to at least one of the base and the upper bearing assembly.

19. A mixing apparatus according to claim 18, wherein the lower bearing assembly has a first mounting member attaching at least one roller assembly to the base, and a second

mounting member attaching at least one roller assembly to the upper bearing assembly.

20. A mixing apparatus according to claim 19, wherein the first mounting member is mounted to, and depends downwardly from, the base.

21. A mixing apparatus according to claim 19, wherein:

the upper bearing subassembly includes a pair of mating bushing blocks surrounding the shaft for sliding engagement therewith;

the second mounting member mounted to, and depending downwardly from, one of the bushing blocks.

22. A mixing apparatus according to claim 21, wherein the lower bearing assembly has first and second roller assemblies supported by the first mounting member, and a third roller assembly supported by the second mounting member; the first, second and third roller assemblies being mounted in surrounding relation to the shaft.

23. A mixing apparatus according to claim 16, wherein the lower bearing assembly has first, second and third roller assemblies mounted in surrounding relation to the shaft.

24. A reciprocating drive assembly for use in a fluid mixer to impart reciprocating movement along a longitudinal axis to a shaft carrying a mixing head for immersion in fluids, the reciprocating drive assembly comprising:

a housing;

a flywheel mounted for rotation about a rotational axis extending substantially normal to the longitudinal axis;

a crank member projecting from the flywheel in a direction parallel to the rotational axis;

a yoke supported by the housing for movement along a yoke axis disposed substantially parallel to the longitudinal axis, the yoke being releasably connected to the shaft, the yoke having a substantially linear race formed therein for receiving the crank member, the race being disposed within the yoke substantially normal to both the rotational axis and the yoke axis;

first and second guide assemblies operatively connected to the housing, and to the yoke for sliding engagement therewith along a pair of guide axes extending substantially parallel to the yoke axis, the pair of guide means being laterally spaced from each other with the yoke disposed substantially therebetween;

wherein when the flywheel is rotatively driven, the crank member is caused to translate linearly within the race thereby urging the yoke to slidingly engage the guide

assemblies and move along the yoke axis to effect longitudinal reciprocating movement of the shaft and the mixing head.

25. A reciprocating drive assembly according to claim 24, wherein each of the first and second guide assemblies is a linear slide assemblies.

26. A reciprocating drive assembly according to claim 25, wherein:

each linear slide assembly includes a guide rail member associated with at least one corresponding guide rail following member;

each guide rail member is fixedly mounted to the housing coincident with one of the guide axes; and

each of the at least one guide rail following members is rigidly connected to the yoke and slidably moveable relative to its corresponding guide rail member.

27. A reciprocating drive assembly according to claim 26, wherein

each guide rail member has upper and lower, spaced-apart, guide rail following members associated therewith.

28. A reciprocating drive assembly according to claim 25, wherein:

each linear slide assembly includes a guide post associated with at least one corresponding linear sliding block;

each guide post is fixedly mounted to the housing coincident with one of the guide axes; and

each of the at least one linear sliding blocks is rigidly connected to the yoke and slidably moveable relative to its corresponding guide post.

29. A reciprocating drive assembly according to claim 28, wherein

each guide post has upper and lower, spaced-apart, linear sliding blocks associated therewith.